

SEQUENCE LISTING

<110> Conkling, Mark

<120> MODIFYING NICOTINE AND NITROSAMINE
LEVELS IN TOBACCO

<130> VTOB.033C1

<150> 60/297,154

<151> 2001-06-08

<150> PCTUS02/18040

<151> 2002-06-06

<160> 58

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<211> 1399

<212> DNA

<213> Nicotiana tabacum

<400> 1

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<211> 351

<212> PRT

<213> Nicotiana tabacum

<400> 2


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<210> 4

<211> 50

<212> PRT

<213> *Nicotiana tabacum*

<400> 4

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Thr Ala Pro Arg Leu Val Val Lys Met Ser Ala Ile Ala Thr Lys Asn
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Thr Arg Val Glu Ser Leu Glu Val Lys Pro Pro Ala His Pro Thr Tyr
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Asp Leu
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<210> 5

<211> 13

<212> PRT

<213> *Rhodospirillum rubrum*

<400> 5

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Arg Pro Asn His Pro Val Ala Ala Leu Ser Phe Ala Ile
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<210> 6

<211> 10

<212> PRT

<213> *Mycobacterium lepre*

<400> 6

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<210> 7

<211> 22

<212> PRT

<213> *Salmonella typhimurium*

<400> 7

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 Leu Asp Ile Ala Ala Val
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<210> 8
 <211> 22
 <212> PRT
 <213> Escherichia coli

<400> 8
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 1 5 10 15
 Leu Asp Ile Gly Ala Val
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<210> 9
 <211> 25
 <212> PRT
 <213> Homo sapiens

<400> 9
 Asp Glu Gly Ala Leu Leu Leu Pro Pro Val Thr Leu Ala Ala Leu Val
 1 5 10 15
 Asp Ser Trp Leu Arg Glu Asp Cys Gly
 20 25

<210> 10
 <211> 26
 <212> PRT
 <213> Saccharomyces cerevisiae

<400> 10
 Pro Val Tyr Glu His Leu Leu Pro Val Asn Gly Ala Trp Arg Gln Asp
 1 5 10 15
 Val Thr Asn Trp Leu Ser Glu Asp Val Ser
 20 25

<210> 11
 <211> 46
 <212> PRT
 <213> Nicotiana tabacum

<400> 11
 Lys Glu Val Met Lys Leu Ala Leu Ser Glu Asp Ala Gly Asn Leu Gly
 1 5 10 15
 Asp Val Thr Cys Lys Ala Thr Ile Pro Leu Asp Met Glu Ser Asp Ala
 20 25 30
 His Phe Leu Ala Lys Glu Asp Gly Ile Ile Ala Gly Ile Ala
 35 40 45

<210> 12
 <211> 29

<212> PRT

<213> *Rhodospirillum rubrum*

<400> 12

Asp	Ala	Val	Arg	Arg	Ala	Leu	Arg	Ala	Ile	Ser	Thr	Ala	Ala	Thr	Arg
1				5					10					15	
Ala	His	Arg	Phe	Val	Arg	Gln	Pro	Leu	Leu	Gly	Cys	Ala			
			20					25							

<210> 13

<211> 38

<212> PRT

<213> *Mycobacterium lepre*

<400> 13

Asp	Thr	Ile	Arg	Arg	His	Leu	Arg	Tyr	Gly	Leu	Ile	Thr	Gln	Val	Ala
1				5					10					15	
Gly	Thr	Val	Val	Thr	Gly	Ser	Met	Val	Pro	Arg	Pro	Val	Ile	Ala	Gly
			20					25					30		
Val	Asp	Val	Ala	Leu	Leu										
			35												

<210> 14

<211> 38

<212> PRT

<213> *Nicotiana tabacum*

<400> 14

Ala	Gln	Ala	Leu	Arg	Glu	Asp	Leu	Gly	Gly	Glu	Val	Asp	Ala	Gly	Asn
1				5					10					15	
Ile	Ala	Gln	Leu	Ala	Thr	Gln	Ala	His	Thr	Val	Ile	Thr	Arg	Asp	
			20				25					30			
Val	Phe	Cys	Gly	Lys	Arg										
			35												

<210> 15

<211> 37

<212> PRT

<213> *Salmonella typhimurium*

<400> 15

Ala	Gln	Ala	Leu	Arg	Glu	Asp	Leu	Gly	Gly	Thr	Val	Asp	Ala	Asn	Asn
1				5					10					15	
Ile	Ala	Leu	Leu	Glu	Asn	Ser	Arg	His	Thr	Val	Ile	Thr	Arg	Asn	Val
			20					25					30		
Phe	Cys	Gly	Lys	Arg											
			35												

<210> 16

<211> 27

<212> PRT

<213> *Homo sapiens*

<400> 16
 Leu Asn Tyr Ala Ala Leu Val Ser Gly Ala Gly Pro Gln Ala Ala Leu
 1 5 10 15
 Trp Ala Lys Ser Pro Val Leu Ala Gly Gln Pro
 20 25

<210> 17
 <211> 28
 <212> PRT
 <213> *Sacharomyces cerevisiae*

<400> 17
 Phe Asp Phe Gly Gly Tyr Val Val Gly Ser Asp Leu Lys Glu Ala Asn
 1 5 10 15
 Leu Tyr Cys Lys Gln Asp Met Leu Cys Gly Val Pro
 20 25

<210> 18
 <211> 43
 <212> PRT
 <213> *Nicotiana tabacum*

<400> 18
 Leu Ala Glu Met Ile Phe Ala Glu Val Asp Pro Ser Leu Lys Val Glu
 1 5 10 15
 Trp Tyr Val Asn Asp Gly Asp Lys Val His Lys Gly Leu Lys Phe Gly
 20 25 30
 Lys Val Gln Gly Asn Ala Tyr Asn Ile Val Ile
 35 40

<210> 19
 <211> 34
 <212> PRT
 <213> *Rhodospirillum rubrum*

<400> 19
 Arg Ser Ala Phe Ala Leu Leu Asp Asp Thr Val Thr Phe Thr Thr Pro
 1 5 10 15
 Leu Glu Ala Glu Ile Ala Ala Gln Thr Val Ala Glu Ala Ala Arg Thr
 20 25 30
 Leu Ala

<210> 20
 <211> 35
 <212> PRT
 <213> *Mycobacterium lepre*

<400> 20
 Val Leu Asp Val Phe Gly Val Asp Gly Tyr Arg Val Leu Tyr Arg Glu
 1 5 10 15
 Ala Arg Leu Gln Ser Gln Pro Leu Leu Thr Val Gln Ala Ala Arg Gly
 20 25 30

Leu Leu Thr
35

<210> 21
<211> 36
<212> PRT
<213> *Salmonella typhimurium*

<400> 21
Trp Val Glu Val Phe Ile Gln Leu Ala Gly Asp Asp Val Arg Leu Thr
1 5 10 15
His Asp Ala Ile Ala Asn Gln Thr Val Phe Glu Leu Asn Pro Ala Arg
20 25 30
Val Leu Leu Thr
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<210> 22
<211> 37
<212> PRT
<213> *Escherichia coli*

<400> 22
Trp Val Glu Val Phe Ile Gln Leu Ala Gly Asp Asp Val Thr Ile Ile
1 5 10 15
His Asp Val Ile Asn Ala Asn Gln Ser Leu Phe Glu Leu Glu Pro Ser
20 25 30
Arg Val Leu Leu Thr
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<210> 23
<211> 36
<212> PRT
<213> *Homo sapiens*

<400> 23
Phe Phe Asp Ala Ile Phe Thr Gln Leu Asn Cys Gln Val Ser Phe Leu
1 5 10 15
Pro Glu Ser Leu Val Pro Val Ala Arg Val Ala Glu Val Arg Pro His
20 25 30
Asp Leu Leu Leu
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<210> 24
<211> 40
<212> PRT
<213> *Saccharomyces cerevisiae*

<400> 24
Phe Ala Trp Val Phe Asn Gln Cys Glu Leu Gln Val Glu Leu Phe Lys
1 5 10 15
Glu Ser Phe Leu Glu Pro Ser Lys Asn Asp Ser Gly Lys Ile Val Val
20 25 30
Ala Lys Ile Thr Pro Lys Leu Leu

35

40

<210> 25

<211> 46

<212> PRT

<213> *Nicotiana tabacum*

<400> 25

Ala	Glu	Arg	Val	Val	Leu	Asn	Phe	Met	Gln	Arg	Met	Ser	Gly	Ile	Ala
1				5					10					15	
Thr	Leu	Thr	Lys	Glu	Met	Ala	Asp	Ala	Ala	His	Pro	Ala	Tyr	Ile	Leu
			20					25					30		
Glu	Thr	Arg	Lys	Thr	Ala	Pro	Gly	Leu	Arg	Leu	Val	Asp	Lys		
		35					40					45			

<210> 26

<211> 24

<212> PRT

<213> *Rhodospirillum rubrum*

<400> 26

Thr	Ala	Leu	Gly	His	Leu	Arg	Arg	Arg	Phe	Gly	Ala	Ile	His	Thr	Arg
1				5					10					15	
Arg	Leu	Thr	Cys	Thr	Gly	Leu	Glu								
			20												

<210> 27

<211> 25

<212> PRT

<213> *Mycobacterium lepre*

<400> 27

Thr	Met	Val	Cys	His	Met	Val	Val	Ala	Trp	Val	Ala	Val	Arg	Gly	Thr
1				5					10					15	
Lys	Lys	Ile	Arg	Asp	Leu	Ala	Leu	Gln							
			20					25							

<210> 28

<211> 29

<212> PRT

<213> *Salmonella typhimurium*

<400> 28

Gly	Thr	Ala	Val	Thr	Leu	Val	Ala	Ser	Glu	Val	Arg	Arg	Tyr	Val	Gly
1				5					10					15	
Leu	Leu	Gly	Thr	Gln	Thr	Gln	Leu	Asp	Leu	Thr	Ala	Leu			
			20					25							

<210> 29

<211> 31

<212> PRT

<213> *Escherichia coli*

<400> 29

Gly Pro Thr Ala Val Thr Leu Val Ala Ser Lys Val Arg His Tyr Val
1 5 10 15
Glu Leu Leu Glu Gly Thr Asn Thr Gln Leu Asp Leu Ser Ala Leu
20 25 30

<210> 30

<211> 31

<212> PRT

<213> Homo sapiens

<400> 30

Gly Ala Thr Leu Ala Arg Cys Ser Ala Ala Ala Ala Val Glu Ala
1 5 10 15
Ala Arg Gly Ala Gly Trp Thr Gly His Val Ala Gly Thr Phe Glu
20 25 30

<210> 31

<211> 32

<212> PRT

<213> Saccharomyces cerevisiae

<400> 31

Thr Ala Ile Leu Ser Arg Ser Thr Ala Ser His Lys Ile Ile Ser Leu
1 5 10 15
Ala Arg Ser Thr Gly Tyr Lys Gly Thr Ile Ala Gly Thr Arg Leu Glu
20 25 30

<210> 32

<211> 50

<212> PRT

<213> Nicotiana tabacum

<400> 32

Trp Ala Val Leu Ile Gly Gly Gly Lys Asn His Arg Met Gly Leu Phe
1 5 10 15
Asp Met Val Met Ile Lys Asp Asn His Ile Ser Ala Ala Gly Gly Val
20 25 30
Gly Lys Ala Leu Lys Ser Val Asp Gln Tyr Leu Glu Gln Asn Lys Leu
35 40 45
Gln Ile
50

<210> 33

<211> 26

<212> PRT

<213> Rhodospirillum rubrum

<400> 33

Tyr Arg Cys Ser Phe Asp Ala Leu Ala Val Ala Ser Ala Ser Arg Ala
1 5 10 15
Arg Ala Gly Val Gly His Met Val Arg Ile

20

25

<210> 34
 <211> 26
 <212> PRT
 <213> Mycobacterium lepre

<400> 34
 Tyr Arg Val Val Leu Gly Thr Ala Leu Val Ala Val Ser Val Asp Arg
 1 5 10 15
 Ala Arg Ala Ala Ala Pro Glu Leu Pro Cys
 20 25

<210> 35
 <211> 25
 <212> PRT
 <213> Salmonella typhimurium

<400> 35
 Tyr Cys Ala Leu Thr Ala Phe Leu Ile Ser Ser Arg Gln Val Glu Lys
 1 5 10 15
 Ala Phe Trp His Pro Asp Ala Pro Val
 20 25

<210> 36
 <211> 25
 <212> PRT
 <213> Escherichia coli

<400> 36
 Tyr Cys Ala Leu Ser Ala Phe Leu Ile Ser Ser Arg Gln Val Glu Lys
 1 5 10 15
 Ala Ser Trp His Pro Asp Ala Pro Val
 20 25

<210> 37
 <211> 34
 <212> PRT
 <213> Homo sapiens

<400> 37
 Tyr Gly Leu Val Ala Ala Ser Tyr Asp Gly Gly Leu Val Met Leu Asp
 1 5 10 15
 Val Val Pro Pro Phe Lys Val Arg Ala Ala Arg Gln Ala Ala Asp Phe
 20 25 30
 Ala Leu

<210> 38
 <211> 31
 <212> PRT
 <213> Saccharomyces cerevisiae

<400> 38

Tyr Ser Met Val Cys Asp Thr Tyr Asp Ser Ser Met Leu Asp Trp Thr
1 5 10 15
Ser Ile Thr Asn Val Asn Ala Arg Ala Val Cys Gly Phe Ala Val
20 25 30

<210> 39

<211> 50

<212> PRT

<213> *Nicotiana tabacum*

<400> 39

Gly Val Glu Val Glu Thr Arg Thr Ile Glu Glu Val Arg Glu Val Leu
1 5 10 15
Asp Tyr Ala Ser Gln Thr Lys Thr Ser Leu Thr Arg Ile Met Leu Asp
20 25 30
Asn Met Val Val Pro Leu Ser Asn Gly Asp Ile Asp Val Ser Met Leu
35 40 45
Lys Glu
50

<210> 40

<211> 21

<212> PRT

<213> *Rhodospirillum rubrum*

<400> 40

Glu Ile Leu Gln Leu Ala Ala Val Gly Gly Ala Glu Val Val Leu Asp
1 5 10 15
Ala Pro Thr Thr Arg
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<210> 41

<211> 25

<212> PRT

<213> *Mycobacterium lepre*

<400> 41

Glu Ser Leu Gln Leu Asp Ala Met Ala Glu Glu Pro Glu Leu Leu Phe
1 5 10 15
Val Trp Gln Thr Gln Val Ala Val Gln
20 25

<210> 42

<211> 21

<212> PRT

<213> *Salmonella typhimurium*

<400> 42

Glu Asn Leu Asp Glu Leu Asp Asp Ala Lys Gly Ala Asp Ile Phe Asn
1 5 10 15
Thr Asp Gln Met Arg

<210> 43
 <211> 18
 <212> PRT
 <213> *Escherichia coli*

<400> 43
 Glu Asn Leu Leu Asp Ala Lys Gly Ala Asp Ile Phe Glu Thr Glu Gln
 1 5 10 15
 Met Arg

<210> 44
 <211> 28
 <212> PRT
 <213> *Homo sapiens*

<400> 44
 Lys Cys Ser Ser Leu Gln Val Gln Ala Ala Glu Gly Ala Asp Leu Val
 1 5 10 15
 Leu Phe Lys Pro Glu Glu Leu His Pro Thr Ala Thr
 20 25

<210> 45
 <211> 26
 <212> PRT
 <213> *Saccharomyces cerevisiae*

<400> 45
 Lys Ile Cys Leu Ser Glu Asp Ala Thr Ala Ile Glu Gly Ala Asp Val
 1 5 10 15
 Phe Lys Gly Asp Gly Leu Lys Cys Ala Gln
 20 25

<210> 46
 <211> 46
 <212> PRT
 <213> *Nicotiana tabacum*

<400> 46
 Ala Val Glu Leu Ile Asn Gly Arg Phe Asp Thr Glu Ala Ser Gly Asn
 1 5 10 15
 Val Thr Leu Glu Thr Val His Lys Ile Gly Gln Thr Gly Val Thr Tyr
 20 25 30
 Ile Ser Ser Gly Ala Leu Thr His Ser Val Lys Ala Leu Asp
 35 40 45

<210> 47
 <211> 20
 <212> PRT
 <213> *Rhodospirillum rubrum*

<400> 47

Asp Met Val Ala Leu Val Gly Ser Asp Ile Ala Ala Leu Ala Glu Ser
1 5 10 15
Asp Val Thr Thr
20

<210> 48

<211> 29

<212> PRT

<213> Mycobacterium lepre

<400> 48

Arg Arg Asp Ile Arg Ala Pro Thr Val Leu Leu Ser Gly Leu Ser Asn
1 5 10 15
Ala Ala Ile Tyr Ala Gly Asp Tyr Leu Ala Val Arg Ile
20 25

<210> 49

<211> 21

<212> PRT

<213> Salmonella typhimurium

<400> 49

Lys Arg Val Gln Ala Arg Leu Val Ala Glu Leu Arg Glu Phe Ala Glu
1 5 10 15
Asp Phe Val Gly Arg
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<210> 50

<211> 20

<212> PRT

<213> Escherichia coli

<400> 50

Lys Arg Thr Lys Ala Leu Leu Val Asp Lys Leu Arg Glu Phe Ala Glu
1 5 10 15
Asp Phe Val Gln
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<210> 51

<211> 33

<212> PRT

<213> Homo sapiens

<400> 51

Leu Lys Ala Gln Phe Pro Ser Val Ala Val Glu Ala Gly Ile Thr Asp
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Asn Leu Pro Gln Phe Cys Gly Pro His Ile Asp Val Met Met Gln Ala
20 25 30
Pro

<210> 52
 <211> 44
 <212> PRT
 <213> *Saccharomyces cerevisiae*

 <400> 52
 Ser Leu Lys Asn Lys Trp Asn Gly Lys Lys His Phe Leu Leu Glu Cys
 1 5 10 15
 Gly Leu Asn Asp Asn Leu Glu Glu Tyr Leu Cys Asp Asp Ile Asp Ile
 20 25 30
 Tyr Thr Ser Ser Ile His Gln Gly Thr Pro Val Ile
 35 40

<210> 53
 <211> 20
 <212> PRT
 <213> *Nicotiana tabacum*

<400> 53
 Ile Ser Lys Leu Ile Asp Thr Glu Leu Ala Leu Glu Val Gly Arg Arg
 1 5 10 15
 Thr Lys Arg Ala
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<210> 54
 <211> 12
 <212> PRT
 <213> *Rhodospirillum rubrum*

<400> 54
 Gly Asp Val Val Ala Pro Pro Lys Ala Glu Arg Ala
 1 5 10

<210> 55
 <211> 6
 <212> PRT
 <213> *Salmonella typhimurium*

<400> 55
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 1 5

<210> 56
 <211> 6
 <212> PRT
 <213> *Escherichia coli*

<400> 56
 Leu Ser Met Arg Phe Arg
 1 5

<210> 57
<211> 11
<212> PRT
<213> Homo sapiens

<400> 57
Phe Leu Phe Lys Val Ala Pro Val Pro Ile His
1 5 10

<210> 58
<211> 4
<212> PRT
<213> Saccharomyces cerevisiae

<400> 58
Phe Leu Ala His
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